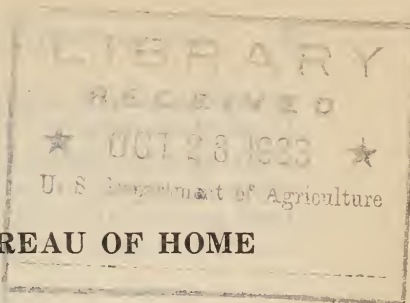


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REPORT OF THE CHIEF OF THE BUREAU OF HOME
ECONOMICS, 1933



UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF HOME ECONOMICS,
Washington, D.C., August 31, 1933.

SIR: I present herewith the report of the Bureau of Home Economics for the fiscal year ended June 30, 1933.

LOUISE STANLEY, *Chief.*

HON. HENRY A. WALLACE,
Secretary of Agriculture.

During the past year the demands for help in the direction of emergency feeding, in food preservation, and in the renovation, making, and purchase of clothing have been greater than at any other time. These calls came not only from agencies administering relief budgets but also from home makers needing help in stretching reduced incomes to meet the needs of the family.

Many relief agencies reported as above their reach the adequate diets at minimum cost which we outlined first in 1930 for use in drought-stricken areas and then later adapted to meet the unemployment situation. As the funds of these agencies became more limited, their need became greater. They asked for help in planning diets that would give the fullest possible return in nutritive value for a small, oftentimes a pitifully small, amount of money. Not from choice, but to meet an emergency, we worked out restricted diets. In publishing these family food budgets we made clear that they were for emergency use only and that they give "irreducible amounts" of protective and other foods below which no diet should ever fall. They may not be adequate for use for a long period of time. We therefore urged relief agencies and individuals to make every effort to return as soon as possible to a diet which provides an ample margin of safety.

As a contribution to the program of adjusting agricultural production to the Nation's social and economic needs, we have completed plans for four typical diets at four levels of cost. In working these out our concern was to provide the essentials for human nutrition, and to point the way toward a balanced agricultural program—two important elements in permanent social progress.

In the textile field, the recently completed study of cotton fabrics woven from three grades of fibers contributes a type of information also needed in adjusting production to consumer needs. Quality standards are an essential part of commodity codes. To be reliable, such standards should be based on actual wearing tests. This study

of cotton fabrics and a similar one under way on wool are designed to yield such facts.

As already implied, our basic research program has been adapted where necessary to emergency needs. In general, however, it has been possible to carry along the main program with shifts in emphasis. The report of specific accomplishments follows:

FOODS AND NUTRITION

FOOD COMPOSITION

As the result of a study of all available data on the mineral content of foods, new lists of foods rich in calcium and phosphorus have been issued. Also information on the fiber content of fruits and vegetables, the composition and nutritive value of soybeans and soybean products, and the composition of milk and milk products has been summarized.

NUTRITION STUDIES

VITAMIN D IN EGGS

The study on the relation between the source of vitamin D in the diet of the hen and the vitamin D content of the egg, carried on in cooperation with the Bureau of Animal Industry, was completed. The results raised a question as to whether the large amount of oil in the diets containing 2 and 4 percent of cod-liver oil might not have had a depressing effect on the utilization of the vitamin D. To answer this question, another series of diets was planned similar to the ones used before, with the exception that all the diets contained the same amount of oil either in the form of cod-liver oil or corn oil. As a part of this study, data are being obtained on the influence of cod-liver oil on the calcium and phosphorus content of the egg.

VITAMINS B AND G IN CEREAL PRODUCTS

The results of the study on the vitamin B and G content of wheat, wheat germ, rice polishings, and yeast were summarized and published. The vitamin B (B_1) and vitamin G (B_2) values, respectively, expressed in terms of Sherman units were as follows: Yeast, 11 and 17; wheat germ, 7 and 3; wheat, 1.5 and 1; rice polishings, 6 and 1; and cottonseed flour, 5 and 2.

A paper giving the results of a study on the behavior of rats of different ages on a vitamin G-deficient diet will soon be published.

GREEN AND WHITE LETTUCE

Several years ago a study was made of the vitamin A, B (complex), and C content of the inner and outer leaves of head lettuce. Before these studies were completed, however, two other investigators made reports on the vitamin A content of head lettuce, and vitamin B was shown to be not a single entity but made up of two separate factors now known as vitamin B or B_1 , and vitamin G or B_2 . As a consequence, the results of the work here were not published. Recently some importance has been attached to green leaves as a source of vitamin G, and for this reason tests have been made to determine both the vitamin B (B_1) and the vitamin G (B_2) con-

tent of the inner and outer leaves of head lettuce. The results indicate that the vitamin B content of the bleached leaves is about twice that of the green leaves, but that the green leaves are about three times as rich in vitamin G as the bleached leaves.

THE YELLOW POTATO

Further work has been done in determining the vitamin A content of a yellow-fleshed potato. The potato tested was a cross between a yellow-fleshed potato obtained in Costa Rica and a white potato. The potato from Costa Rica was small, similar in appearance and texture to a white potato, but had very yellow flesh. The seedling from the cross had pale yellow flesh and was of fair size. Tests showed that it contained very small but detectable amounts of vitamin A.

QUANTITATIVE VITAMIN VALUES

During the last few years a great deal of information on the vitamin content of various foodstuffs has appeared in the literature. Many requests for information of this kind are received. It was considered advisable to bring this material together, and as far as possible to express these values quantitatively. Most of the data used in deriving the values are from studies completed before the Permanent Commission on Biological Standardization of the League of Nations adopted the international vitamin units. Since the units described by Sherman are used extensively, they have been selected for expressing the values for vitamins A, B, C, and G. All available references are being reviewed in order to obtain values for all foods on which any data are given, from which values can be estimated, if not derived directly. Curves of reference for each of the vitamins have been worked out from data obtained in the nutrition laboratory and these are used in making many of the estimates. These data will be published in the revision of *Vitamins in Food Materials*, first issued in 1929 in cooperation with the Office of Experiment Stations.

MINERAL STUDIES

In connection with the study of the influence of production factors on the composition of eggs, a summary has been prepared on the mineral content of eggs. A study of the rare minerals has been planned, using a Littrow-type spectrograph to identify the presence of certain elements determined only with difficulty by the usual methods.

Recently special interest has been directed to the toxicity of plants grown on soil containing selenium. The suggestion was made that small amounts of selenium in the diet might be beneficial. This is known to be true in the case of boron and some other elements. It was decided to test this hypothesis by feeding a grain known to contain minute amounts of selenium. This grain is being fed to rats as 2.5, 5, 10, 20, 40, and 58 percent of a well-balanced diet. The results obtained to date do not indicate that any beneficial effects are derived from the use of this grain in small amounts. Beginning at the level of 10 percent there is a very definite depression of the growth curve. Reproduction was also affected unfavorably by the higher percentages.

FOOD UTILIZATION

The activities in food utilization were continued along three lines, namely, research in food preparation, cooking quality and palatability of foods in relation to production factors, and preservation of food by household methods. A summary of the results follows:

COOKING FATS

Six commercial lards, two hydrogenated lards, and a hydrogenated cottonseed oil have been studied, in cooperation with the Bureau of Animal Industry, for flavor and creaming volume. Intensity and desirability of flavor of the fats was judged in hot biscuits, cold pastries, and as melted fat alone. The preliminary results show that there is a very small spread in the intensity and desirability of the flavor of the fats when used in pastry. The differences in desirability of flavor were more pronounced. The hydrogenated cottonseed oil and one of the hydrogenated lards were significantly less desirable than the other fats. The fats with the least flavor were not always considered the most desirable.

Creaming volumes were determined on the nine fats at temperatures of 18°, 21.5°, and 25° C. The creaming volume of the fats ranged from 0 to 60 percent over all the temperatures. There was a temperature for each fat at which its creaming volume was the highest after a definite time of beating. The ability of the fat to incorporate air seemed to depend upon the temperature at which the fat was creamed and was more directly related to its congealing point than to the melting point. The fat with the highest congealing point had the largest creaming volume.

EGG QUALITY AND PREPARATION

The cooperative study of the influence of production factors on the quality of eggs for use in food preparation has been continued. A method for the measurement of the leavening power of eggs was developed. Measurements on the yolks and whites for total solids, hydrogen-ion concentration, and carbon dioxide, and for viscosity of the fresh egg magma of a large number of standard eggs have been recorded for comparison with the figures on cake volume. For this purpose the volume, compressibility, and tensile strength of 25 lots of eggs have been studied.

MEAT QUALITY

The study of meat quality has been continued in cooperation with the Bureau of Animal Industry, Bureau of Agricultural Economics, and State experiment stations.

A study of the shrinkage and cooking time of roast lamb and mutton in relation to carcass grade and cooking temperature has been completed and awaits publication. According to the results, the shrinkage of lamb and mutton during roasting depends on the grade of the meat, the length of time ripened after slaughter, the oven temperature used, and the stage to which the meat is cooked, whether thoroughly well done at 83° C. or between medium and well done at 76°. The length of time in the oven depends on these same

factors, as well as on the weight of the roast. Most of these legs of lamb were aged 4 to 9 days, and all were cooked by methods which included searing and a slow finish. Lamb that is excessively fat is wasteful because it loses so much fat during cooking. On the other hand very thin lamb that grades as Common or Cull takes a surprisingly long time to cook in proportion to weight, particularly when the oven temperature is as low as 125°. Lamb of the Choice, Good, and Medium grades cooked to the stage between medium and well done (76°) shrank on the average 14 percent and required 34 minutes per pound when the oven temperature for the finish was 125°. When the cooking was finished at 150° or 175°, the average shrinkage was 17 to 19 percent, and the time required was 21 to 25 minutes per pound. A significant finding of this study was that lamb cooked thoroughly well done (83°) shrank the same amount, between 25 and 30 percent, whether cooked for 1 hour per pound at 125°, or less than half as long at 175°. This is contrary to the general belief that a low oven temperature holds down the shrinkage in meat. It is apparent from these figures that the stage to which lamb was cooked made more difference on the shrinkage than did the oven temperature. This is a good argument for a roast meat thermometer in addition to an oven thermometer because the meat thermometer shows when the desired stage of doneness is reached and prevents overcooking and excessive shrinkage.

To clarify certain points in meat cooking technic, the constant-temperature roasting of beef ribs, leg of lamb, and loin of pork was compared with methods that include initial searing. The results show that initial searing improves the appearance of roasts and makes them cook faster. Searing does not tend to hold in the juices of roasts. On the contrary, it may cause the roasts to lose more weight, but the extra loss is mainly fat. The flavor, tenderness, and juiciness of the inside lean of a roast did not appear to be influenced by searing, although the flavor of the fat of the seared roasts was considered slightly better.

Another series of experiments, comparing constant moderate oven temperature with a combination of quick searing and a very slow finish for rare beef and medium-to-well-done lamb showed that faster cooking and higher shrinkage are associated with constant-temperature roasting. The results on cooking time and shrinkage suggest that average oven temperature has more influence on these factors than does initial searing. The appearance of meat cooked medium to well done at constant moderate temperature was satisfactory, but small cuts cooked to the rare stage were usually not browned attractively.

A further contribution was also made to the methodology of cooking meats. At the request of a standing committee of the cooperative meat investigations, the directions for roasting beef, veal, lamb, and pork were revised for use in the palatability tests on cuts from experimental animals. Illustrations were added showing how to sample the cooked-meat cuts, and the directions for the use of score cards were amplified. Another new feature is a discussion of procedure for conducting experiments in meat cookery so as to reduce variables to the minimum and make the findings comparable.

VEGETABLE AND FRUIT STUDIES

The study of potato quality has been continued in cooperation with the Bureau of Plant Industry. Seventeen seedlings were cooked and judged, of which 5 rated good, 10 fair, and 2 poor. A study of the chemical nature of the constituents in potatoes which cause blackening after cooking indicated that they are similar or related to the groups of chemical compounds characterized as the catechol type of tannins. It had been found earlier that a practical method of preventing blackening of potatoes was to cook them in slightly acidified water.

Experimental work on frying potato chips showed that satisfactory chips could be made from unpared potatoes, after the potatoes were mature enough for the skin to set. Washing the potatoes to remove excess starch was found to be necessary to prevent sticking, but soaking the slices in water before frying was not essential. A more crisp texture was obtained on prolonged soaking, but the flavor of the chips was decreased. The age of the potato affected the temperature of frying. Old potatoes gave the best chip at frying temperatures of 173 to 177° C., and new potatoes at a temperature of 165 to 168° C.

A method for frying carrot chips was developed. Because of their high sugar content, the low frying temperature of 140° to 145° C. was necessary to prevent overbrowning.

The study of the table quality of different varieties of green soybeans was continued in cooperation with the Bureau of Plant Industry. Several varieties native to Chosen (Korea) and Japan were found to have a texture and flavor that made a desirable green vegetable. Some of the soybeans required too long a cooking period to be practical for this use. Cooking tests were also run on several new rice samples.

A circular, *Conserving Food Value, Flavor, and Attractiveness in Cooking Vegetables*, was issued. This discusses the pros and cons of baking, steaming, boiling, and pan-frying vegetables, gives a time table for cooking the common kinds, and includes suggestions for serving.

A study of the juice content of oranges of various sizes, but of the same grade, of California Valencia and Washington Navel and of Florida varieties, showed that 1 pound of any of the different varieties or sizes produced approximately 1 cup of juice. This information is more significant than a comparison of the juice obtained from a dozen oranges of different sizes and varieties because of seasonal and geographical differences in cost.

Three varieties of sesame seed submitted by the Arizona Agricultural Experiment Station were studied to determine ways of using them in the diet. These seeds, which are very rich in calcium, are palatable when toasted and may be used in any recipes in which nuts are called for, or in place of any of the small seeds used on hard rolls or shortbreads, in cookies or muffins, and in candy.

THICKENING BY USE OF EGGS OR STARCH

At the request of the terminology committee of the American Home Economics Association a study of equivalents of different starches and eggs for thickening was made. It was found that 21 percent solutions or equivalent weights of whole egg, egg yolk, and egg

white would give gels of similar strength, and mixtures of similar consistency. The study of the common starchy thickening agents, including potato starch, cornstarch, and hard- and soft-wheat flours, showed that they had viscosities of decreasing value in the following order: Potato flour, potato starch, cornstarch, and wheat flours. Mixtures of the same concentration prepared from different lots of the same starches and different brands of cornstarch varied in viscosity. It was found that while potato flour and potato starch had a greater viscosity than cornstarch, they required a more concentrated suspension to form a gel of the same strength. The wheat flour also required a more concentrated suspension to form a gel of the same strength as cornstarch.

FOOD PRESERVATION

Food-preservation studies included canning, jelly making, and drying of vegetables. Bacteriologic and organoleptic examinations for spoilage of the pork and chicken canned in 1931 were completed. The time and temperature tables for processing these foods derived from these observations are being further checked by thermocouple studies to show heat penetration of canned beef and pork and bacteriological study of containers of pork after inoculating with heat-resistant bacteria, processing, and storage.

Measurements on the major jelly juices and jellies made from them were continued through the third season. Study of the data on juices of two seasons shows variations in specific gravity, viscosity, and acidity. The variations were reflected in the quality of jelly.

Many States recognized the value of community canning centers in their relief program and asked advice on equipment and methods of handling and processing the different fruits and vegetables. In cooperation with the Extension Service and the Bureau of Agricultural Engineering, a circular entitled "Community Canning Centers" was prepared. Step by step it emphasizes the important points in the planning and successful operation of such an enterprise. Where canning is done on a large scale by amateurs, trained supervision and strict adherence to methods known to insure thorough sterilization of the canned foods is necessary not only to prevent loss of food but to safeguard the health of the people who use the canned products. For 8 years this Bureau has advocated the processing of all nonacid vegetables only under steam pressure at temperatures higher than are obtainable in the boiling-water bath. Repeated experiments in the research laboratories here and elsewhere back this up. Also the reports that come from community canning centers and the thousands of individuals who have turned to home canning in the economic crisis furnish additional proof of the soundness of this recommendation.

ECONOMIC STUDIES

FAMILY BUDGETS AND PURCHASING

The work of the Economics Division during the past year has been mainly directed toward meeting the demand for practical material on family budgets and purchasing. Requests for such material have continued to pour in from home makers themselves, and from relief

agencies, extension workers, and others concerned with helping families to make the most of their limited resources.

The need for assistance in planning food expenditures has been especially great, and further publications on low-cost diets have been added to those issued during preceding years. One of these is an 8-page folder on Family Food Budgets for the Use of Relief Agencies, giving the quantities of different foods needed weekly by families of various size to provide an adequate diet at minimum cost and a restricted emergency diet for use when funds are too low to make fully adequate nutrition possible. This folder was prepared in cooperation with the Children's Bureau of the Department of Labor to supplement the pamphlet issued jointly last year on Emergency Food Relief and Child Health. Several reports have also been prepared on dietary adjustments in the present economic emergency, for presentation to groups of public health officials, relief workers, and home economists.

In addition to this popular material on low-cost diets, a more technical publication has been prepared on Diets at Four Levels of Nutritive Content and Cost. This is now in press. The four diets presented include a liberal diet, a moderate-cost adequate diet, a minimum-cost adequate diet, and a restricted diet for emergency use. Each is shown in terms of the quantities of foods or groups of foods required yearly on a per capita basis for the population of the United States, and in terms of quantities needed yearly by individuals of different ages and degrees of activity. Quantities needed yearly and weekly by families of typical compositions are also included.

The liberal diet represents a fully adequate food supply. It is made up of items from different food groups in such quantities and proportions as to promote better-than-average nutrition. Both the minimum- and moderate-cost adequate diets provide enough of the different nutrients to cover average requirements for maintenance and growth, and to furnish a fair margin of safety. The restricted diet for emergency use provides approximately the minimum requirements of the body for the various nutrients and allows but little margin for safety. The general use of either of the two diets at the highest levels of nutritive content would undoubtedly improve the health and efficiency of the population. At the same time, it would foster the type of agriculture which represents wise utilization of land for the country as a whole.

Both the nutritive values and costs of the four suggested diets may be modified by the selection made among individual articles of food within each food group. Costs are also greatly affected by the quality of the foods selected. Therefore a brief summary of quality and size grades for many foods is included. Some of the other factors affecting costs are discussed briefly, including the packaging of food, the size of purchase, the seasonal variations in food prices, and the local and general price levels.

To meet the needs of extension workers and rural relief agencies, a summary was made of the ways in which farm families are adjusting their expenditures and their home-production programs to meet the depression. As part of the Outlook Conference for 1933, a summary was also prepared of the available facts relating

to the outlook for farm family living, covering the family income, the retail prices of the goods the family buys, and the adjustments indicated in family expenditures and in home production. This report was prepared by a joint committee representing this Bureau, the Bureau of Agricultural Economics, and the Extension Service, and was published in the *Agricultural Outlook* for 1933.

Material has also been brought together on suggested budgets for city families of limited means. This information has been made available to various public and private agencies interested in family budgets and in wage adjustments, and has served as a basis for answering hundreds of individual requests.

STANDARDS OF LIVING

The investigation of farm-family living in the southern Appalachian highlands, which is part of a larger cooperative study of social and economic conditions in that area, has been continued. The data from the studies of 228 families in Knott County, Ky., and 331 families in Grayson County, Va., have been summarized in graphic form and will appear as part of a joint report prepared by the Bureau of Agricultural Economics, the Forest Service, the Office of Education of the Department of the Interior, and the agricultural experiment stations of four Southern States. Information on living conditions in the southern Appalachian area from the 1930 census and from other sources has also been presented in this graphic summary.

The results of these studies of mountain families show the very low incomes which prevail in this area, and the importance of opportunities for industrial employment to supplement the income from the farm. The total expenditures for family living averaged only \$450 for the Kentucky group in 1929-30 and only \$399 for the Virginia group a year later. To this meager living was added the food, fuel, and other supplies furnished by the farm, which approximately equaled the cash expenses in money value.

FOOD-CONSUMPTION TRENDS

As part of the southern Appalachian highlands study, an analysis was made of the nutritive value, adequacy, and cost of the diets of the mountain families in Knott County, Ky. Some of the results of this study are presented in the section on family living, of the graphic summary of social and economic conditions.

An analysis has also been undertaken of the nutritive value and cost of the diets of three groups of wage-earning families in France, England, and Wales, from data collected by Horace Davis as part of an investigation of family living in those countries. The results of this analysis will afford an interesting contrast with the information on food consumption now being secured from dietary studies of wage-earning families in the United States.

Work has been proceeding, within the limits of the staff available, on a summary of the adequacy of American diets and of food-consumption trends as shown by the various dietary studies of rural and urban families made in this country. Work has also been continued on the nutritive value, cost, and suitability of children's diets

in the home and in institutions. A preliminary report has been issued on a special study of the food habits of preschool children, made in cooperation with mothers who are members of an honorary educational society.

TEXTILES AND CLOTHING

CLOTHING IN RELIEF PROGRAMS

The procurement of adequate clothing became a serious problem in many families during the past year. This brought numerous requests to the Bureau for information regarding clothing relief programs, economic buying, and the care and renovation of clothing. Considerable attention was therefore given to supplying material on this subject.

Relief sewing involving thousands of garments was done by rural women under the supervision of the Extension Service and by various women's organizations. In cooperation with the American Red Cross, the Bureau formulated suggestions for increased economies and efficiency in this work. A circular was issued giving instructions for equipping and conducting community workrooms. Certain types of clothing which could be made satisfactorily and economically by volunteer help were recommended after a careful study of all aspects of the problem. This circular is now used throughout the country by relief agencies and other groups assisting with such work. Other circulars discuss the planning of expenditures when the income is reduced, quality standards as a guide to buying, and the reconditioning of used garments.

Many farm families have also been attempting to make use of unsalable raw materials on hand and augment the family income by various types of handicrafts. To meet demands for information on these subjects, the Bureau has prepared instructions for the scouring and carding of raw wool at home and making it into batts for bedding. Lists of books and sources of supplies have been compiled dealing with handicrafts such as hand weaving and rug making.

COTTON-FABRICS STUDY

The comparative study of the value of different cottons in consumer use was continued. An intelligent production program must be based on the usefulness of the product to the ultimate consumer. At the present time no one knows the relative durability and relative desirability, from other standpoints, of different grades and varieties of cotton fibers when woven into fabrics. No information is available on the effect of conditions of growth of cotton on the wearing qualities of the finished goods. The Bureau is the first research organization to attempt a systematic study of this problem of great economic importance. Such information is fundamental to effective planning of cotton production in this country, and it is unfortunate that these facts are not available in the present emergency.

As a beginning, a technical bulletin is now in press reporting a cooperative study with the Bureau of Agricultural Economics on cottons selected to represent three grades of American upland cotton.

These cottons were made into standard types of sheetings because of the comparative simplicity of this construction and the possibility of giving the fabrics controlled and uniform use in an experiment of this kind. The sheets were placed in actual service during a period of 3 years and were tested at various intervals during their wear life for breaking strength, bursting strength, weight per square yard, fluidity in cuprammonium solution, copper number, and methylene-blue absorption.

In the case of all three of the cottons all the physical and chemical tests showed a progressive deterioration with service. They also showed that initially the Good Middling and Middling cottons were of the same order, but that the Strict Good Ordinary was weaker and that at the end of 200 launderings it was slightly more deteriorated than were the others after 225. A statistical study of the life and time of first break ranked the Middling above the Good Middling and the latter above the Strict Good Ordinary.

The copper number and the methylene-blue-absorption values indicated that for the major portion of its wear life the cellulose of the Strict Good Ordinary cotton was less degraded than was that of the other two cottons. The type of oxidized cellulose characterized by greatly increased methylene-blue absorption was formed as a result of wear and laundering.

There was no increased wear on the middle fold of the sheets and there were no changes due to storage for 3½ years. The appreciable differences in deterioration of the various sections of the sheets indicate that the wear alone is significant in determining the life of such textiles, contrary to the opinion of some investigators who have reported that laundering and not wear is chiefly responsible for deterioration of sheetings.

In a second portion of this study the three sheetings made from cottons selected to represent three grades of American upland cotton were desized by the enzymic method and submitted to controlled ironing conditions with a household ironer of the roll type. Similar changes were obtained at the high ironing temperatures for all three sheetings, which had been in sliding contact with the heated metallic surface for approximately 2½ seconds. The oxidation product in each case was characterized by low methylene-blue absorption and increased copper numbers.

An investigation of the wearing qualities of sheetings made from nonirrigated, irrigated, and a mixture of these cottons is also in progress in cooperation with the Bureau of Agricultural Economics. These have been put into use in a Washington hotel, and physical and chemical tests are being made on samples removed at intervals.

COTTON-FABRIC FINISHING

A technical paper, *Stiffness in Fabrics Produced by Different Starches and Starch Mixtures*, was published. This reports the effects on the stiffness of a sized cotton fabric produced by varying concentrations of starch pastes, by additions of borax and fat to the pastes, and by changes in humidity.

The pliability of fabrics stiffened with various starches, such as potato, canna, corn, wheat, rice, and dasheen, is now being in-

vestigated. This is done by measurements made on films prepared from typical starch pastes. Since the tensile strength, elongation, and folding endurance are all determining factors in this property of pliability, such measurements are being made. Potato starch film has been found to have the greatest tensile strength, with canna, rice, dasheen, corn, and wheat following in the order named. The results on thickness of films and in a general way the elongation were also in this order. An instrument for measuring the folding endurance of starch films has been devised, and these determinations are now in progress.

WOOL-FABRICS STUDIES

In cooperation with the Bureau of Animal Industry, a study of the relative merits of different kinds of new and reworked wool when woven into fabrics is being made with fibers produced over a period of years by controlled breeding and feeding experiments. This is an effort to determine the comparative value of these fibers from the standpoint of their ultimate use. It is also a part of a study of the influence of various animal-husbandry practices on the manufacturing properties of wool.

These wools were made into blankets under carefully controlled conditions. Blankets were chosen because their construction and use can be regulated experimentally. They were placed in service in the wards of a United States veterans' hospital 2 years ago and will be used there until no longer serviceable. Samples are removed and the deterioration tested at regular intervals. These blankets are subjected both to wear and laundering. Another series has been washed at a commercial laundry 50 times without wear. Those tested to date show a high shrinkage accompanied by increase in thickness and weight per square yard and decrease in air permeability.

Nitrogen determinations on blankets which had been laundered until too weak to continue in service and which had lost appreciable weight showed that the total nitrogen content had been maintained. A rapid dilution modification of the Kjeldahl method of determining nitrogen in this material had been developed. This new method is also applicable to silk and similar proteins. Gradual progressive damage in the scales of the wool fiber occurred with repeated washings, as measured by the Pauly diazotization test. The increase in this value was small, however, as compared with the decrease in tensile strength.

KARAKUL INVESTIGATIONS

As part of the study on karakul-sheep production which is being carried on cooperatively with the Bureaus of Animal Industry and Biological Survey, this Bureau has investigated methods of determining the gloss of the skins. This is one of their most important properties from the standpoint of market value. An instrument recently developed by A. H. Pfund, of Johns Hopkins University, has been found applicable to this work, and measurements have been made on skins produced under different animal-husbandry practices. The instrument also has possibilities as a means of determining the amount of curl on karakul skins, a second property of value in the market. This subject is now under investigation.

LINEN STUDY

A preliminary study of the serviceability of one type of hotel table damask has been completed. This was undertaken in order to obtain preliminary data on the relation of some of the construction features of these fabrics to their wearing qualities. Such information is needed both by institutional and household buyers. The linen, a single damask, was no longer serviceable after being used 2 years. In that period it had been laundered 200 times. The majority of the breaks were due to failure of the filling yarns. There was considerable variation in the length of service of individual pieces. The first break in the napkins occurred in a range of 58 to 197 launderings, the average being 128. The tablecloths ranged from 86 to 181 launderings for the first repair, with an average of 120. Most of the breaks occurred in the border sections, and the most significant type of wear occurred in lines parallel to the selvages and the hems.

INFORMATION SERVICES

The four exhibits installed at the Century of Progress Exposition in Chicago are an outstanding feature of the information work for the year. The booth in the Federal Building depicts the services this Bureau renders to the home in planning the family budget, explaining the principles of a well-balanced diet that safeguards health, arranging kitchen equipment into a labor-saving sequence, and providing quality standards for the selection of household textiles and clothing. In the Dairy Industry Building our exhibit deals with the important place of milk and dairy products in the family diet. It shows the kinds and quantities of foods to select when food money is plentiful and when an adequate diet must be provided at minimum cost. The application of scientific research to the cooking of meat is the underlying idea of the third exhibit, installed in the Agriculture Building in cooperation with the meat industry. A display of 18 wax models of cooked cuts of beef, pork, and lamb are a feature attracting large crowds. A second series of six wax models of beef rib roasts illustrates the effect of different oven temperatures on the appearance of the whole roast, the loss in drippings, and the way the meat looks at the center of the roast when carved. A series of 50 colored lantern slides showing the principles of cooking meat according to the cut is also included. The fourth exhibit is in the Social Science Building. It contrasts the home of a hundred years ago with the home of today and points out the value of home economics research and teaching in adjusting to new conditions.

The radio and the press, as well as articles in scientific and trade journals and bulletins in the regular series, were again the means of giving the public full benefit of the research in home economics. The weekly press release entitled "The Market Basket" continued to furnish newspapers and relief agencies with timely suggestions on low-cost food. Menus and recipes showed how to use inexpensive "protective" foods, that is foods rich in vitamins, minerals, and other essentials to good nutrition. Reliable methods of home canning and preserving foods were also given wide publicity. In short, the information services were keyed as far as possible to the economic situation.

